

- 1) If you are **accelerating** at a rate of **26 m/s²**, **how long** does it take you to **reach 70 m/s** if you **start** from a **stand still**?

Knowns: **a = 26m/s²** **v_f = 70m/s** **v_i = 0m/s** **t = ?**

$$\text{Equation: } a = \frac{v_f - v_i}{t} \rightarrow t = \frac{v_f - v_i}{a}$$

Manipulate this equation to have time on the left by multiplying both sides by time and dividing both sides by acceleration. (Show this step mathematically)

$$\text{Plug in knowns } t = \frac{v_f - v_i}{a} = \frac{70\text{m/s} - 0}{26\text{m/s}^2} = 2.7\text{s}$$

- 2) You want to pass the car next to you because it is going too slow and you are late for school. Your **initial velocity is 30 mi/h**. You **speed up to 45 mi/h** in **3 s**. You pass the car without causing an accident. What is your **acceleration**?

Knowns: **t = 3s** **v_f = 45m/h** **v_i = 30m/h** **a = ?**

You need to change the time into hours to fit with the velocity unit.

$$t = 3\text{s} \times \frac{1\text{h}}{3600\text{s}} = \frac{1\text{h}}{1200}$$

$$\text{Equation: } a = \frac{v_f - v_i}{t}$$

$$\text{Plug in knowns: } a = \frac{v_f - v_i}{t} = \frac{45\text{mi/h} - 30\text{mi/h}}{\frac{1\text{h}}{1200}} = 18,000\text{mi/h}^2$$

- 3) What is your **acceleration in kilometers per hour** if you go **from 5 mi/h** **to 120 mi/h** in **0.05 h**? (THINK: unit conversions needed!)

Knowns: **t = .05h** **v_f = 120mi/h** **v_i = 5mi/h** **a = ?**

$$\text{Equation: } a = \frac{v_f - v_i}{t}$$

$$\text{Plug in knowns: } a = \frac{v_f - v_i}{t} = \frac{120\text{mi/h} - 5\text{mi/h}}{0.05\text{h}} = 2,300\text{mi/h}^2$$

$$\text{Change to km/h}^2 \quad a = 2,300\text{mi/h}^2 \times \frac{1\text{km}}{0.62\text{mi}} = 3709.7\text{km/h}^2$$

Write these out mathematically. 4-6

4) $54\text{g} = 1.9\text{oz} = 0.12\text{lbs} = 5.95 \times 10^{-5} \text{ ton} = 0.0000595\text{tons}$

Conversions used: $\frac{1\text{oz}}{28.35\text{g}}, \frac{1\text{kg}}{1000\text{g}}, \frac{2.205\text{lbs}}{1\text{kg}}, \frac{1\text{ ton}}{2000\text{lbs}}$

5) $39\text{ yd} = 35.7\text{m} = 1404\text{in} = 0.02\text{mi}$

Conversions used: $\frac{0.914\text{m}}{1\text{yd}}$ or $\frac{1\text{m}}{3.28\text{ft}}, \frac{12\text{in}}{1\text{ft}}, \frac{3\text{ft}}{1\text{yd}}, \frac{1\text{mi}}{1,760\text{yd}}$

6) $42\text{oz} = 1.3\text{qt} = 1243.2\text{mL} = 0.33\text{gal}$

Conversions used: $\frac{29.6\text{mL}}{1\text{oz}}, \frac{1\text{gal}}{128\text{oz}}, \frac{4\text{qt}}{1\text{gal}}$

For 7 and 8, use khdbdcm

7) $50\text{ km} = 500\text{hm} = 5,000\text{dkm} = 50,000\text{m} = 500,000\text{dm} = 5,000,000\text{cm} = 50,000,000\text{mm}$

8) $200\text{mg} = 0.2\text{g}$

Scientific Notation (9-12) Easy to check with a calculator.

9) $500200 = 5.002 \times 10^5$

10) $30.7 = 3.07 \times 10$

11) $900,000 = 9 \times 10^5$

12) $20490000 = 2.049 \times 10^7$

Write all knowns and necessary equations to solve.

13) Find the volume of a liquid that has a density of 4 g/mL and a mass of 50 grams.

Knowns: $\rho = 4\text{g/mL}$ $m = 50\text{g}$ $V = ?$

Equation: $\rho = \frac{m}{V} \rightarrow V = \frac{m}{\rho}$

Plug in knowns: $V = \frac{m}{\rho} = \frac{50\text{g}}{4\text{g/mL}} = 12.5\text{mL}$

- 14) Find the density in **g/mL** of a liquid that has a **mass of 30 kilograms** and a **volume of 60,000 liters**. (Pay attention to units)

Knowns: **$m = 30\text{kg} = 30,000\text{g}$** **$V = 60,000\text{L} = 60,000,000\text{mL}$** **$\rho = ?$**

Equation: $\rho = \frac{m}{V}$

Plug in knowns: $\rho = \frac{m}{V} = \frac{30\text{kg}}{60,000\text{L}} = \frac{30,000\text{g}}{60,000,000\text{L}} = 0.0005\text{g/mL}$

- 15) I have an oddly shaped item I need to find the volume. I have a bucket that is 2 foot tall and **1 foot in diameter** filled with water **up to 13 inches**. If the **water level rises 2 inches** when I place the object in the bucket, what is the volume of my object?

Knowns: **$d = 1\text{ft} = 12\text{in} \rightarrow r = 6\text{in}$** **$h_i = 13\text{in}$** **$h_f = 13 + 2\text{in} = 15\text{in}$**

This problem can be solved two ways.

- 1) Subtract the initial volume from the final volume.

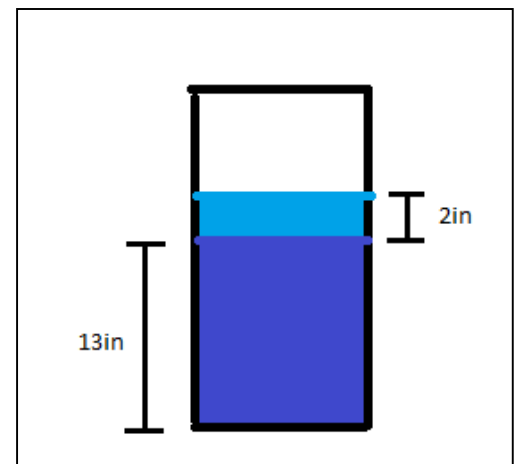
$$V_f = \pi r^2 h = \pi (6\text{in})^2 15\text{in} = 1696.46\text{in}^3$$

$$V_i = \pi r^2 h = \pi (6\text{in})^2 13\text{in} = 1470.27\text{in}^3$$

$$V_{\text{object}} = V_f - V_i = 226.19\text{in}^3$$

- 2) Find the volume using the 2in displacement of water level as the height.

$$V_{\text{object}} = \pi r^2 h = \pi (6\text{in})^2 2\text{in} = 226.19\text{in}^3$$



- 16) If there is a constant mass and volume, what will the effect be on the pressure if the temperature increases in a system?

This answer is found on the Boyle's Law page with the animation. (On wikipedia under assignments.)

- 17) How is pressure involved in a reciprocating engine?

This is something you can easily look up online.